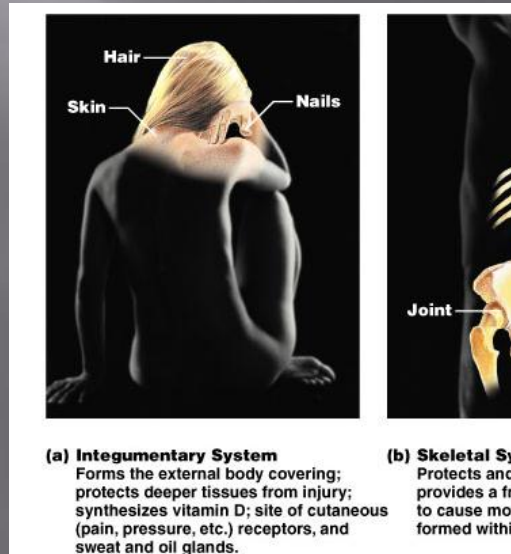


Ch 5: Integumentary System

You gotta have skin;
All you really need is skin.
Skin's the thing, that if you've got it
outside,
It helps keep your insides in.

Alan Sherman (1924-1973)



(a) Integumentary System

Forms the external body covering; protects deeper tissues from injury; synthesizes vitamin D; site of cutaneous (pain, pressure, etc.) receptors, and sweat and oil glands.

(b) Skeletal System

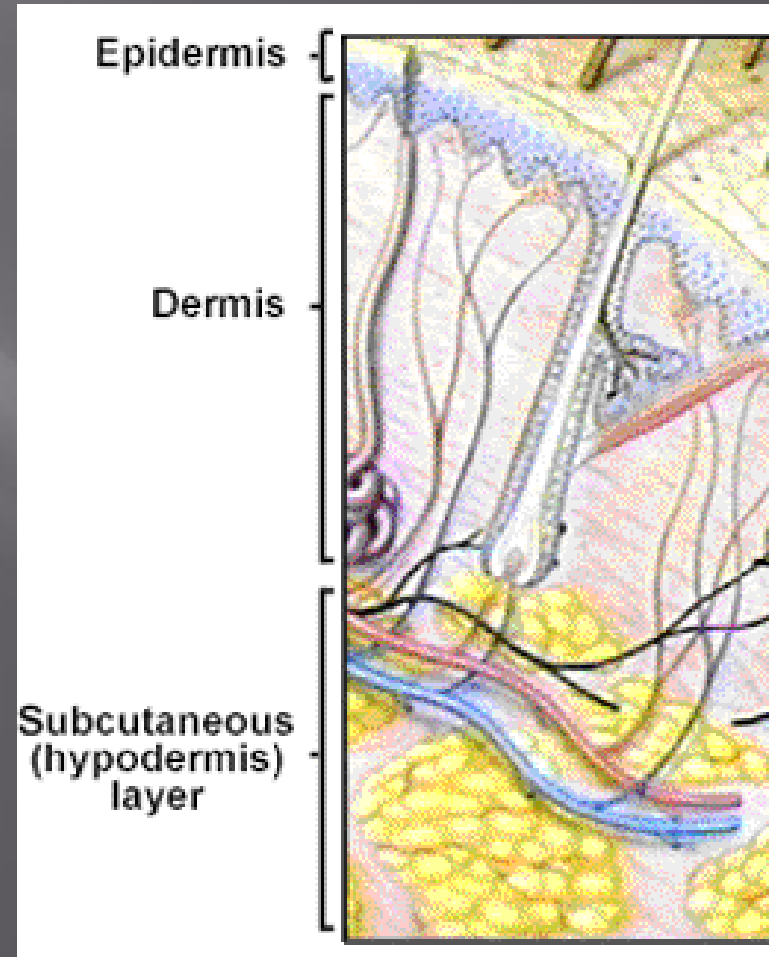
Protects and supports the body; provides a framework for movement; and houses organs formed within.



Developed by
John Gallagher, MS, DVM

Two Major Subdivisions

- ▣ Cutaneous Membrane, i.e. skin
 - Epidermis
 - Dermis
 - Hypodermis
- ▣ Accessory Structures
 - Excretory glands (?)
 - Hair
 - Nails



Function of skin

- ▣ Protection
 - Mechanical
 - Immune
- ▣ Heat regulation
- ▣ As a membrane
 - Absorption
 - Excretion
- ▣ Vitamin D metabolism
- ▣ Sensation

INTEGUMENTARY SYSTEM

- Physical protection from environmental hazards
- Thermoregulation
- Excretion
- Synthesis and storage of lipid reserves
- Synthesis of vitamin D₃
- Provides sensory information
- Coordinates immune response to pathogens and cancers in skin

CUTANEOUS MEMBRANE

EPIDERMIS

- Protects dermis from trauma, chemicals
- Controls skin permeability, prevents water loss
- Prevents entry of pathogens
- Synthesizes vitamin D₃
- Sensory receptors detect touch, pressure, pain, and temperature
- Coordinates immune responses to pathogens and skin cancers

DERMIS

PAPILLARY LAYER

- Nourishes and supports epidermis

RETICULAR LAYER

- Restricts spread of pathogens penetrating epidermis
- Stores lipid reserves
- Attaches skin to deeper tissues
- Sensory receptors detect touch, pressure, pain, vibration, and temperature
- Vessels assist in thermoregulation

ACCESSORY STRUCTURES

HAIR FOLLICLES

- Produce hairs that protect skull
- Produce hairs that provide delicate touch sensations on general body surface

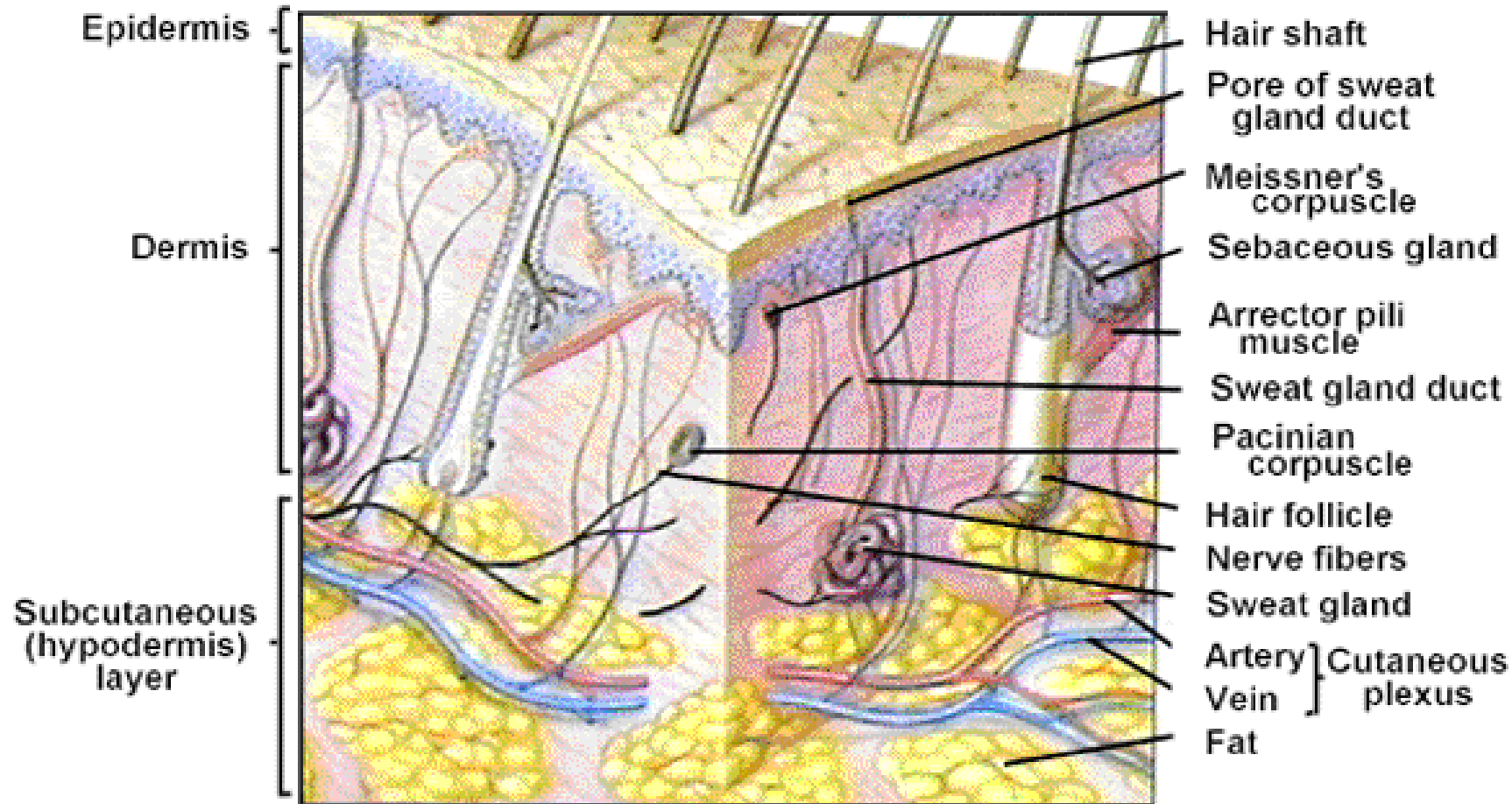
EXOCRINE GLANDS

- Assist in thermoregulation
- Excrete wastes
- Lubricate epidermis

NAILS

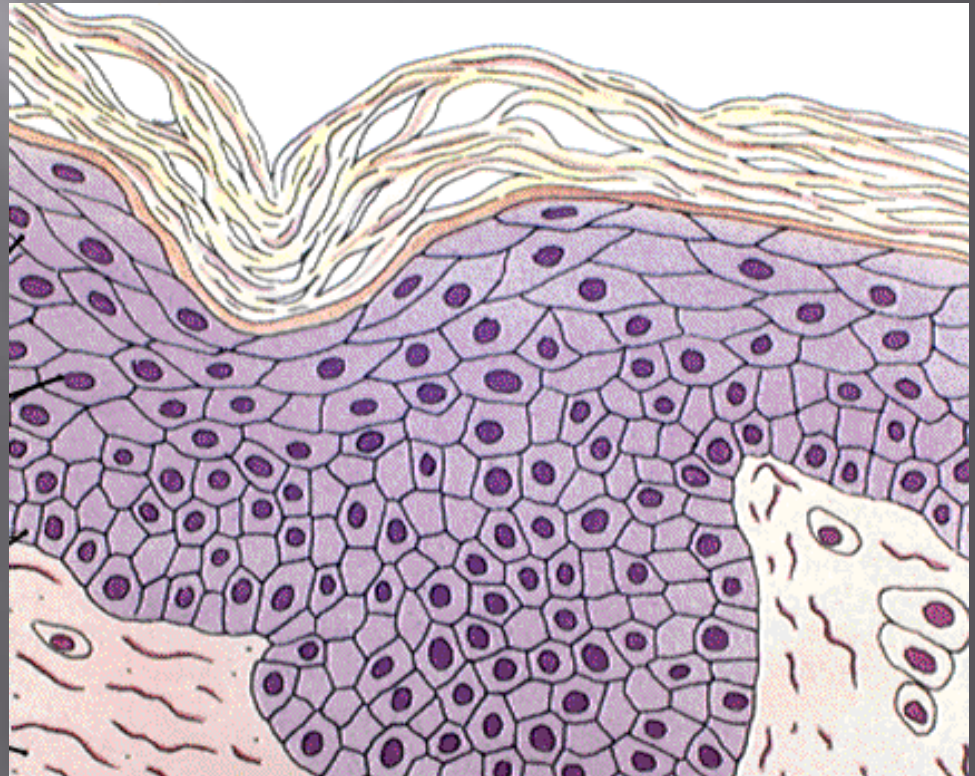
- Protect and support tips of fingers and toes

Made up of all 4 tissue types

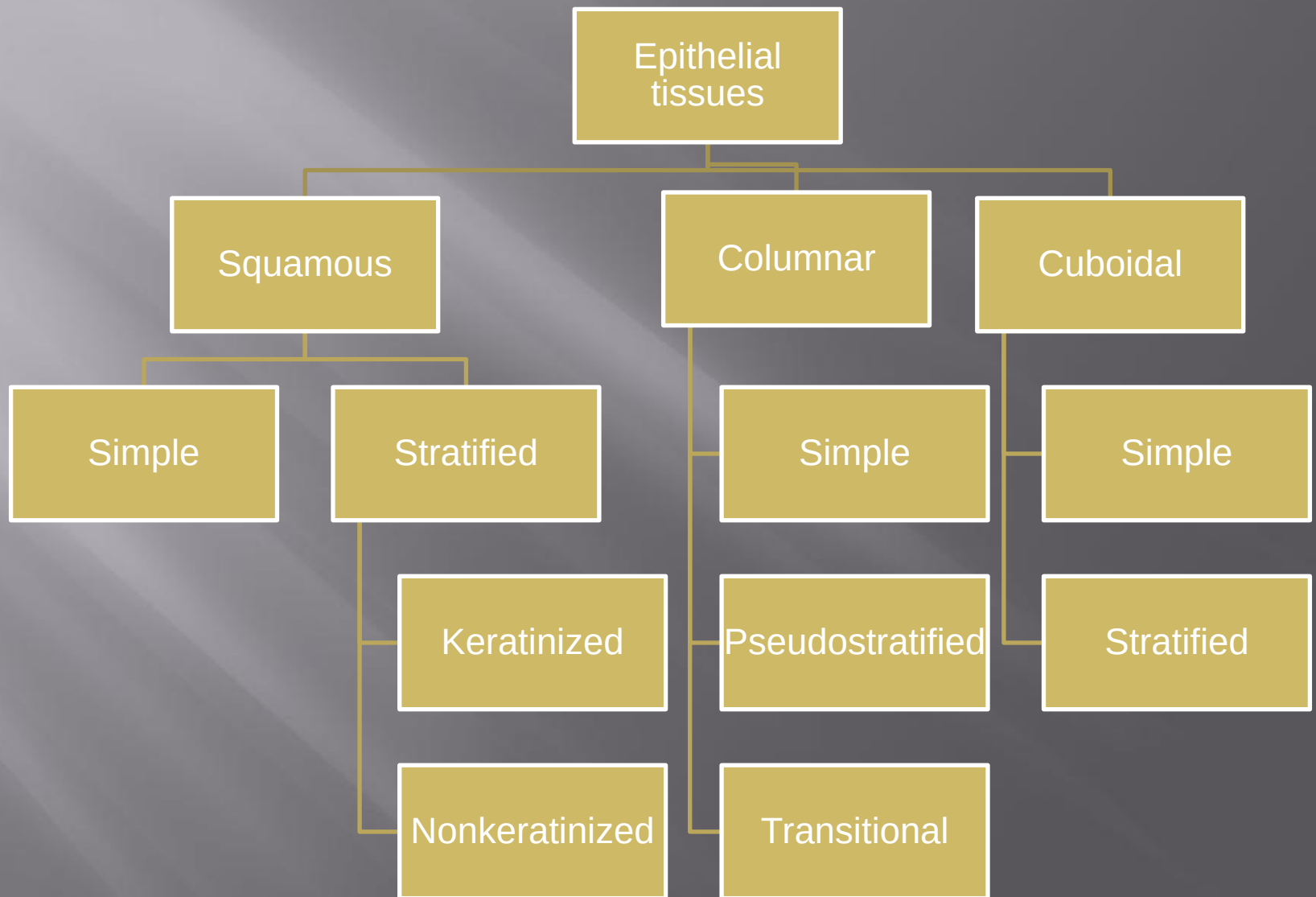


Epidermis

- ▣ Type of Epithelium?
- ▣ Avascular
- ▣ Different layers (= strata)
 - 4 layers in thin skin
 - 5 layers in thick skin



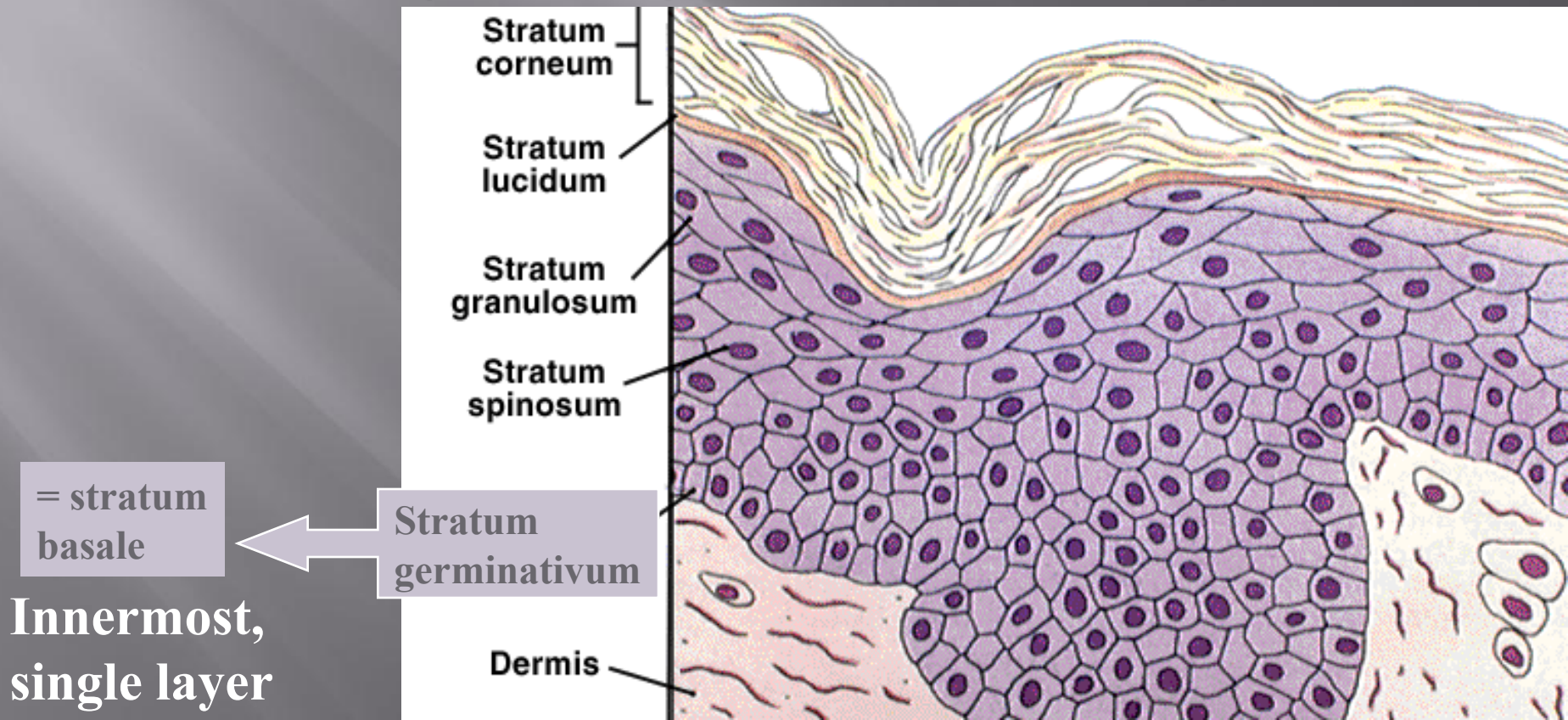
A Concept Map (from Histo, Part 1)



Stratum Germinativum

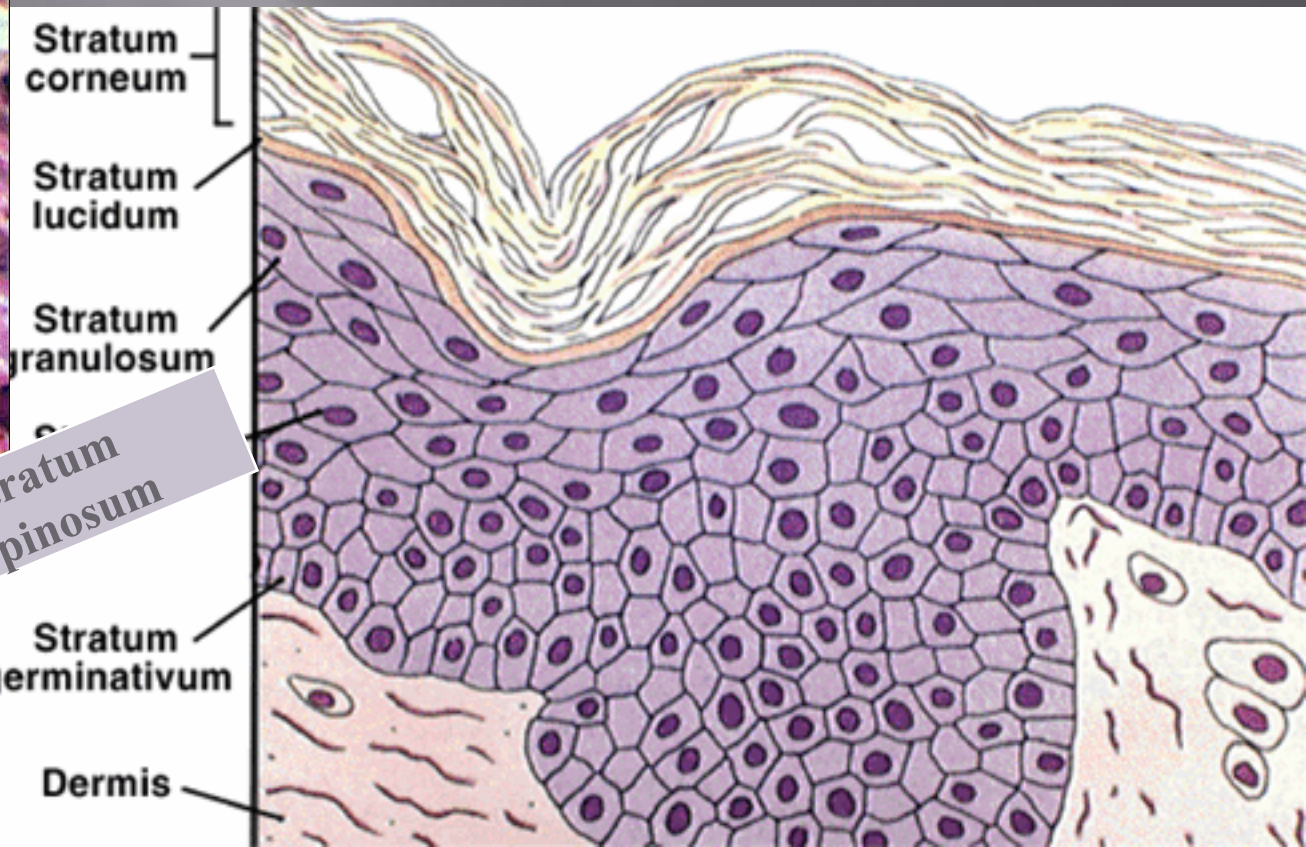
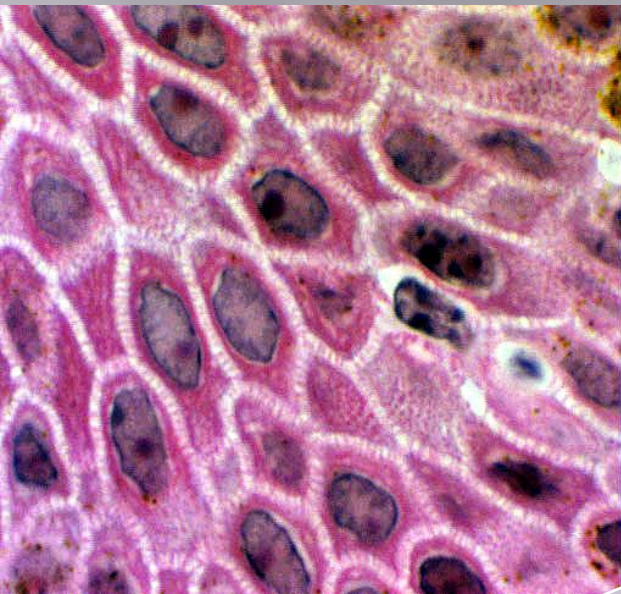
Cell types:

- ▣ Stem cells (basal cells)
- ▣ Melanocytes
- ▣ Merkel cells (touch receptors in hairless skin only)



Stratum Spinosum

- ❑ Stem cell daughter cells (some can still divide)
- ❑ Establishment of Desmosomes
 - The desmosomes create the “spines” as artifact pulls the cells apart



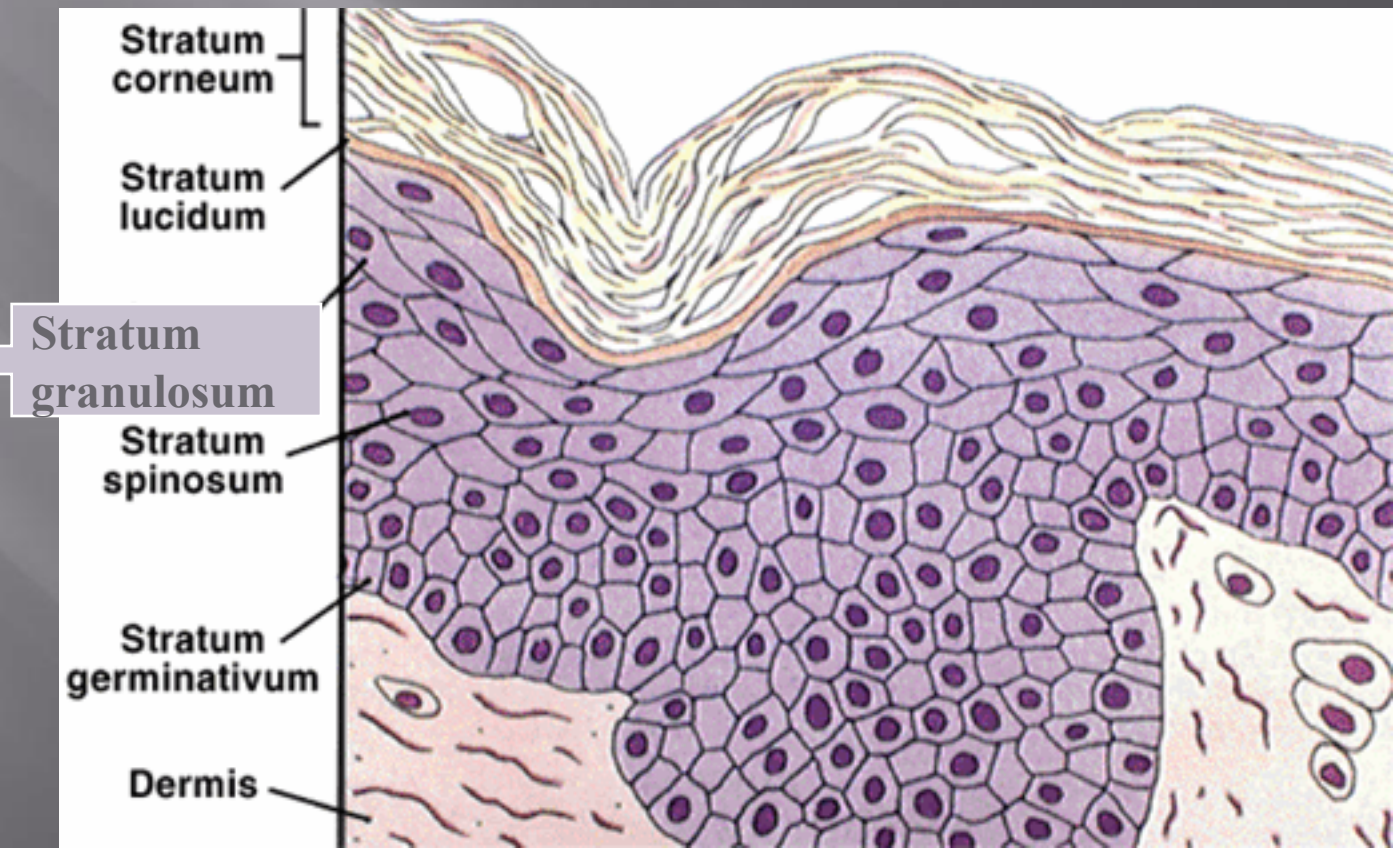
Stratum
spinosum

Several cells
thick

Stratum Granulosum

- ▣ Cells displaced from stratum spinosum → Keratinocytes
- ▣ Production of keratohyalin and keratin fibers
- ▣ Cells start to die. Dehydration leaves interlocked layers of keratin and keratohyalin

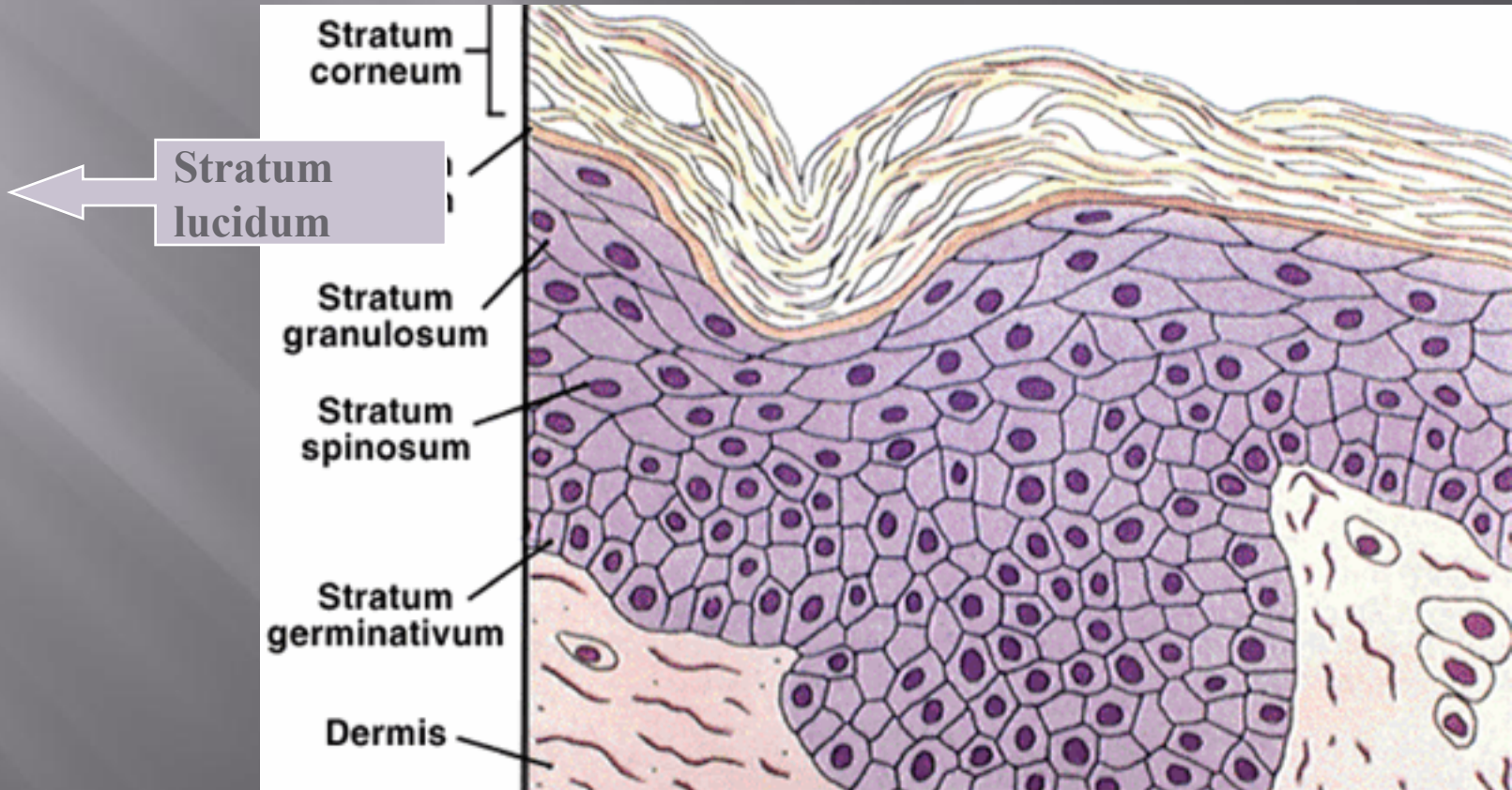
Small
granules of
keratin



Stratum Lucidum

- ▣ In “thick skin” only, i.e., palms of hands and soles of feet
- ▣ Cells do not stain well → clear (lucid) looking

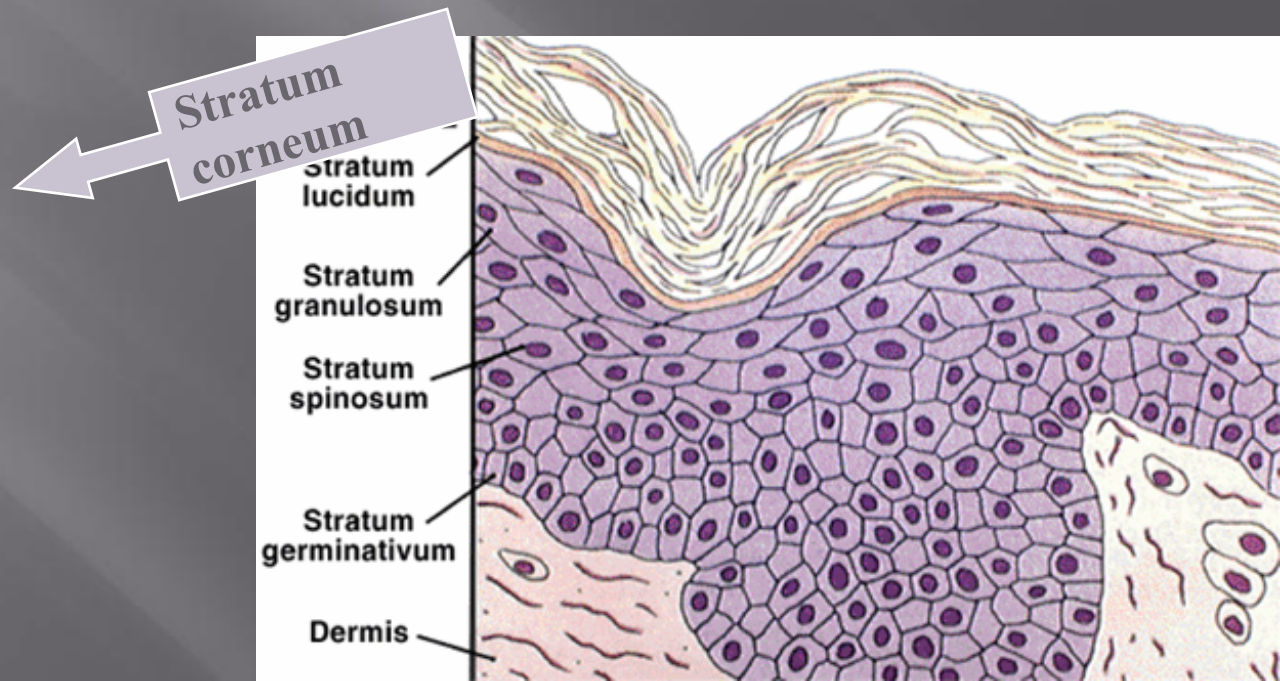
Mostly
keratin



Stratum Corneum

- ▣ Many layers of flattened, dead cells, filled with keratin
- ▣ Continually sloughed
- ▣ Water-resistant but not water proof ($\Rightarrow$ insensible perspiration)
- ▣ Relatively dry - advantage?
- ▣ Keratinization occurs everywhere except for anterior surface of eye

15-30 layers
(much thicker
in thick skin)



Thin

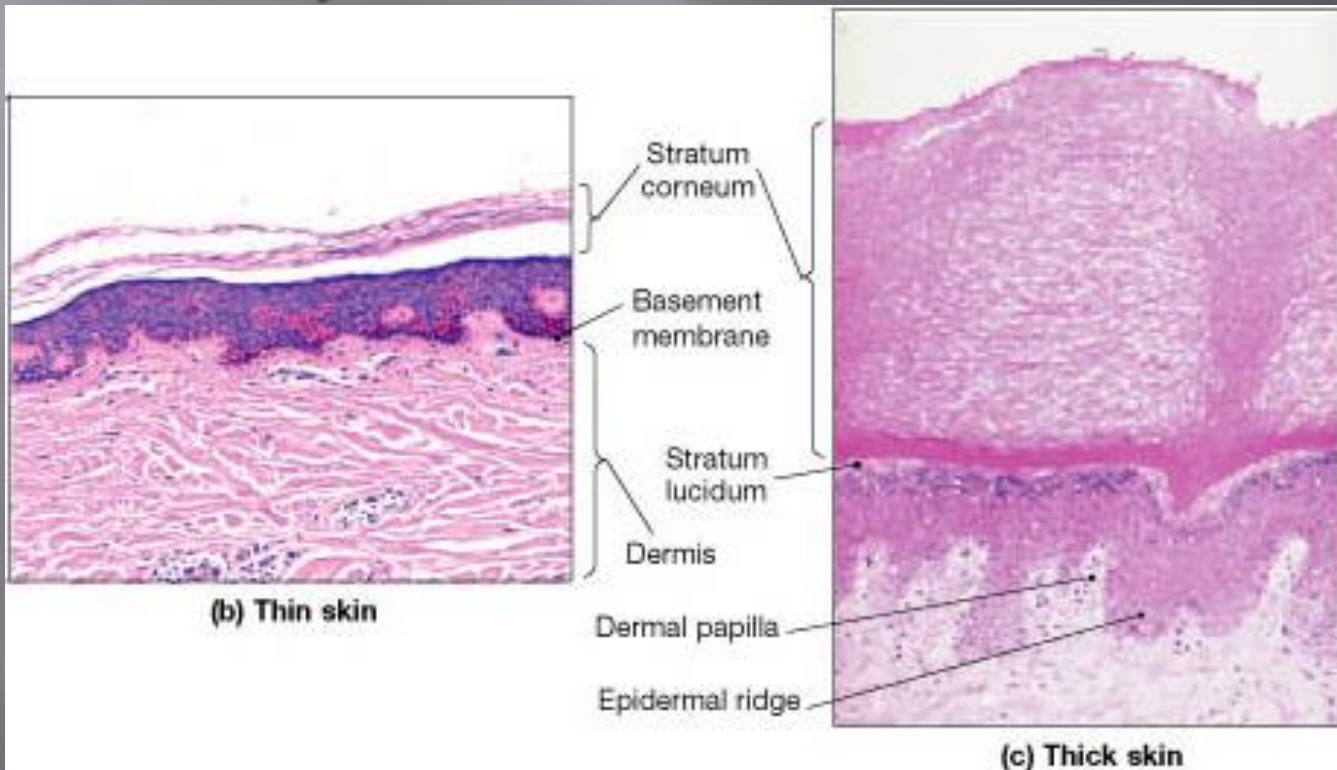
vs.

Thick Skin

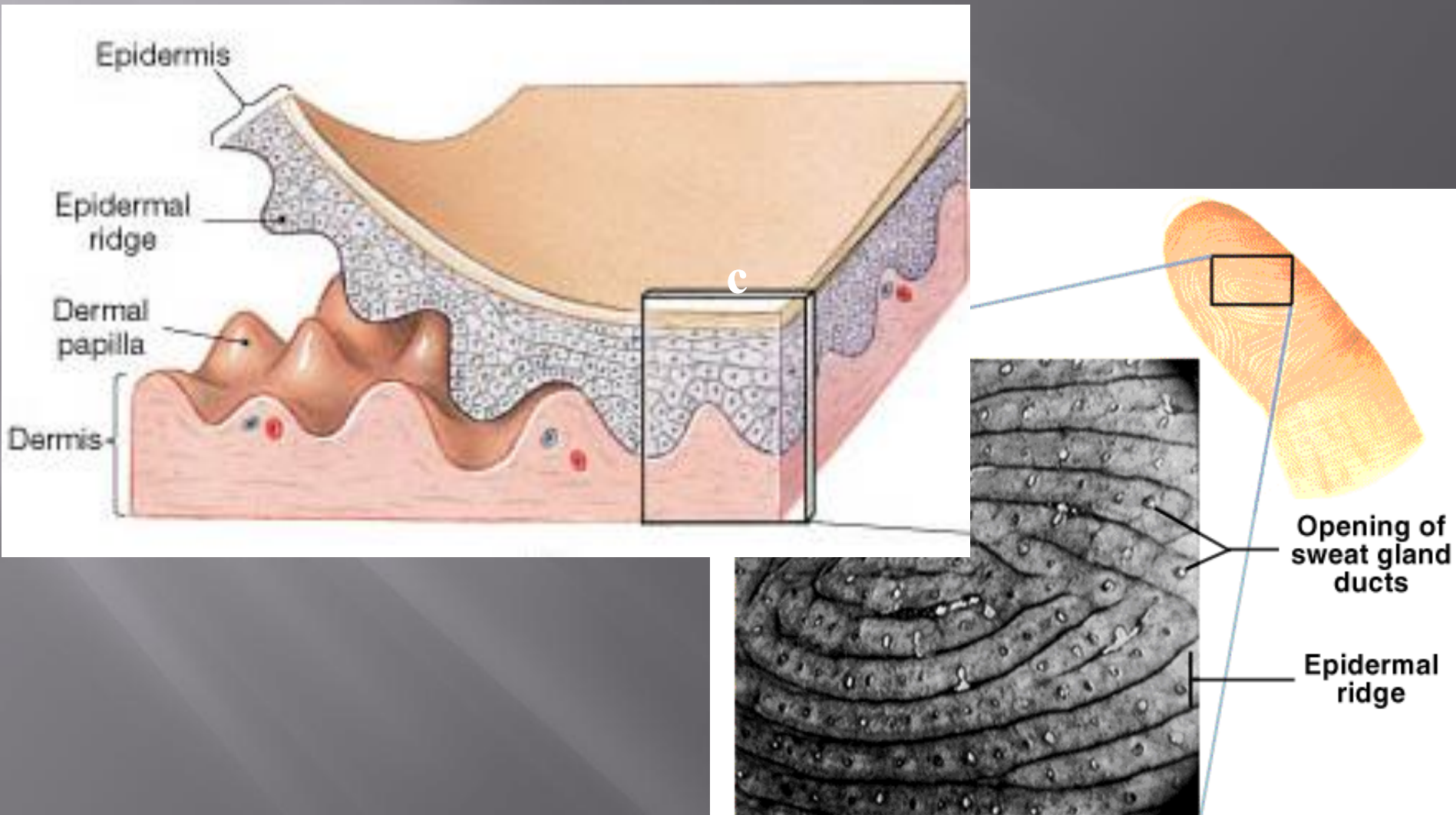
Refers to epidermis

- ▣ Average 0.08 mm
- ▣ Most of body

- ▣ Up to 1.5 mm
- ▣ Where??



Contour of skin surface follows pattern of epidermal ridges.



Skin Color

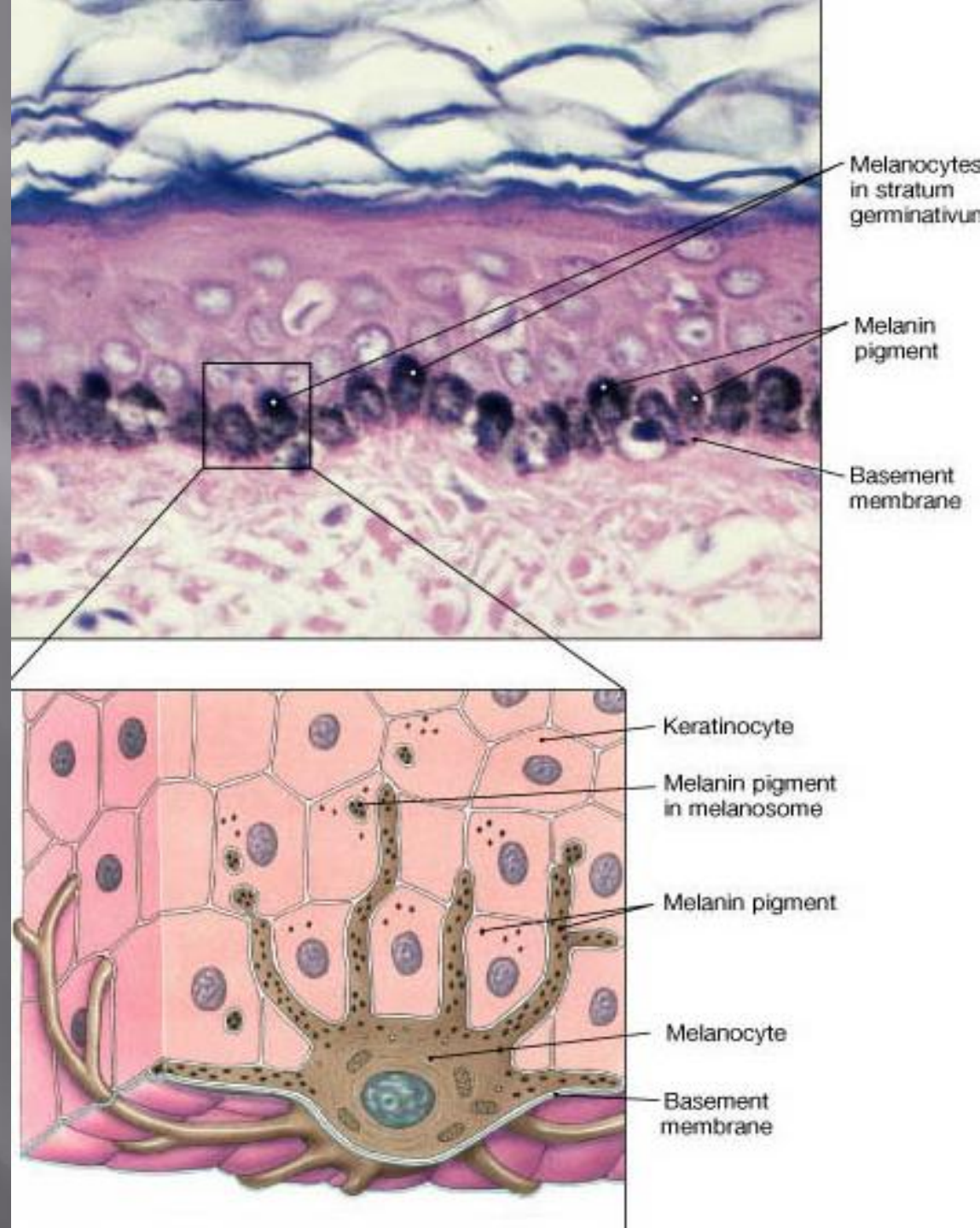
Depends on 3 pigments:

- ▣ Hemoglobin (dermal blood supply)
 - Reddish tones
 - Pale, due to?
 - Bluish (=?), due to?
- ▣ Melanin
 - Produced by melanocytes of stratum basale
- ▣ Carotene
 - Obtained from plant foods

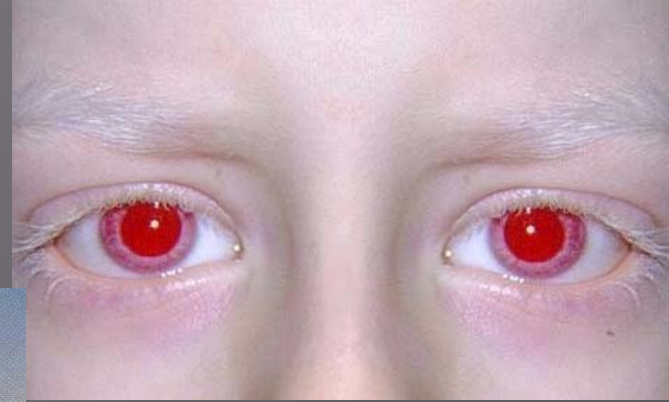
Melanocytes

Function ? UV
protection?

Number of
melanocytes same
in all people,
production levels
differ !



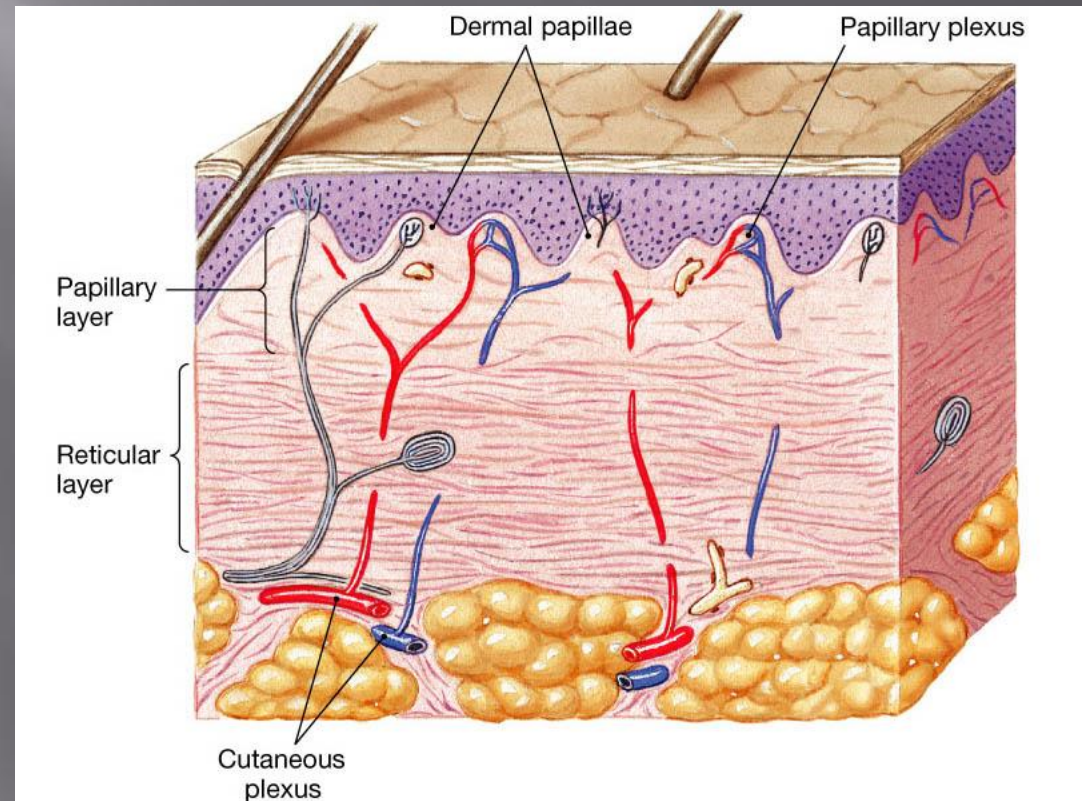
Albinism



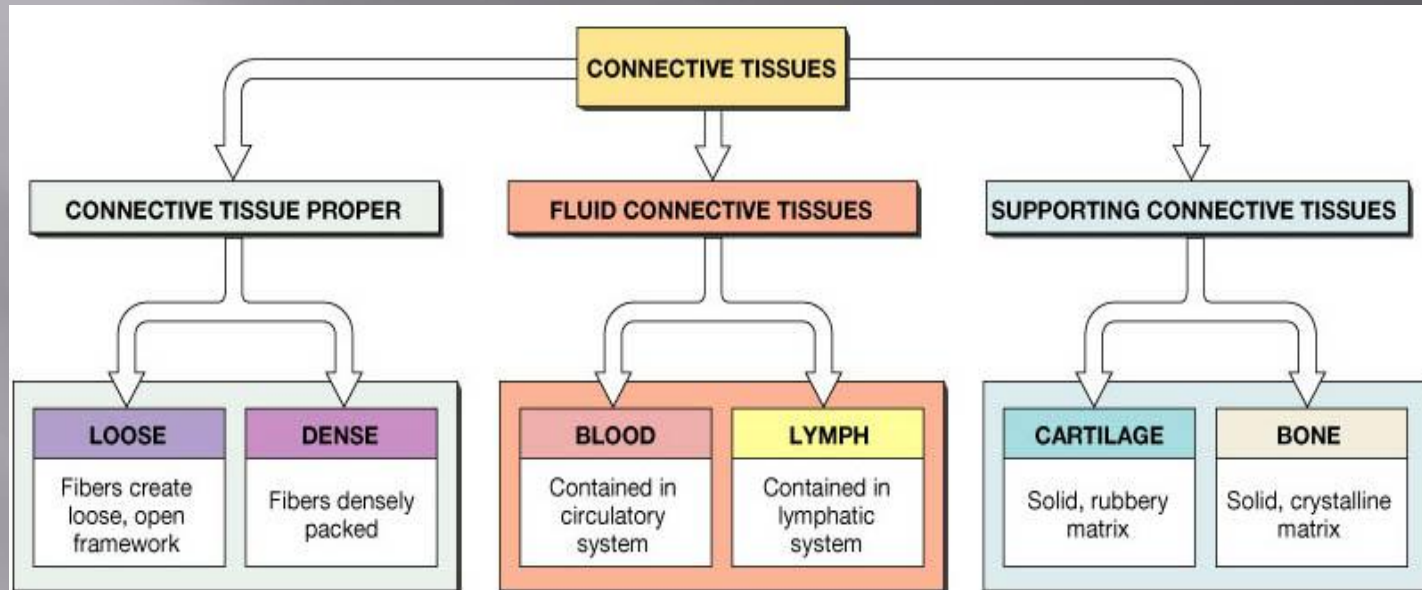
Vitiligo

Dermis

1. Papillary layer
Areolar (loose)
c.t.
2. Reticular layer
dense irregular
c.t.



Review of Connective Tissue



- Loose (areolar)
- Reticular
- Adipose

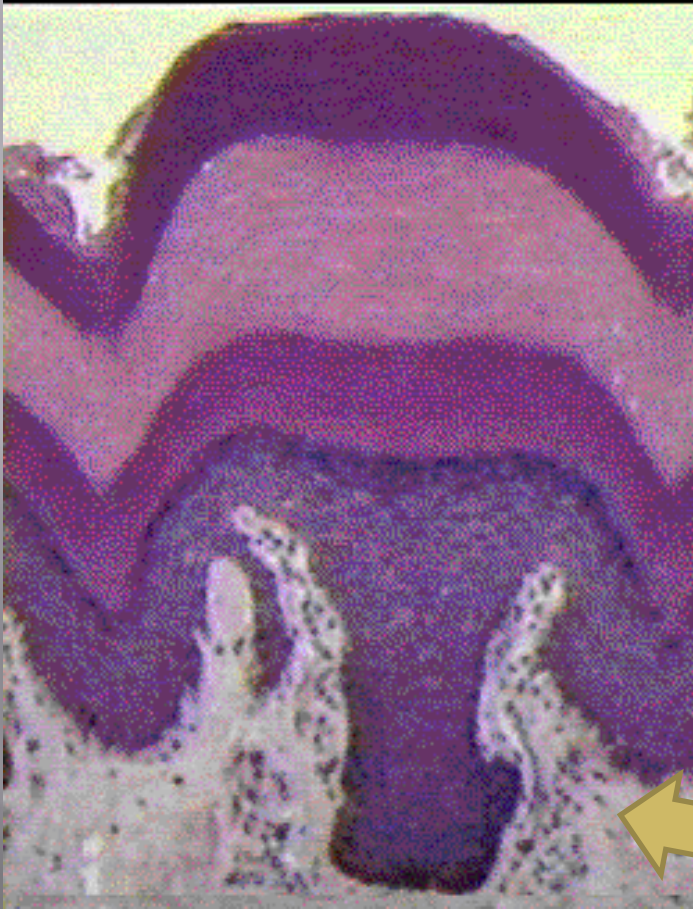
- Irregular
- Regular
- Elastic

- Hyaline
- Elastic
- Fibrocartilage

- Compact
- Spongy

This is similar to Table 4.2

1. Papillary Layer

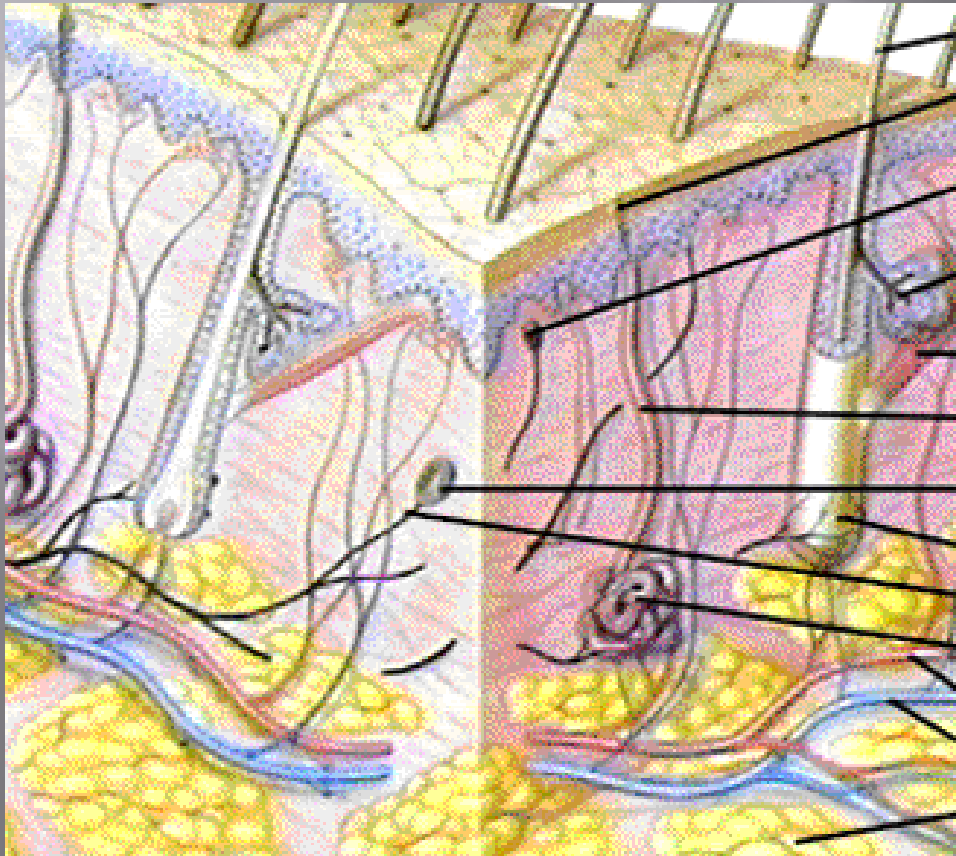


- ▣ Dermal papillae project between epidermal ridges.

Consist of

- ▣ Areolar c.t.
- ▣ Capillaries
- ▣ Tactile receptors

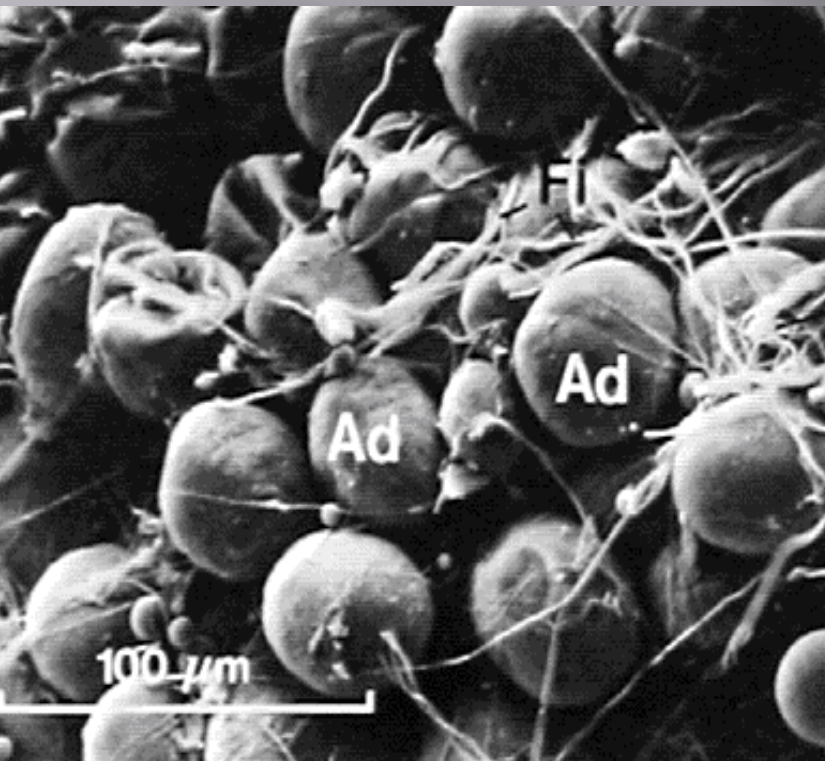
2. Reticular Layer



Consists of

- ▣ Dense irregular c.t.
- ▣ Accessory Structures
 - Hair
 - Glands
 - Nerves
 - Blood Supply

Hypodermis



- ▣ 2 other names
 - Subcutaneous Layer (subcutis)
 - Superficial fascia
- ▣ Indistinct boundary (c.t. fibers interwoven)
 - Loose c.t.

Function

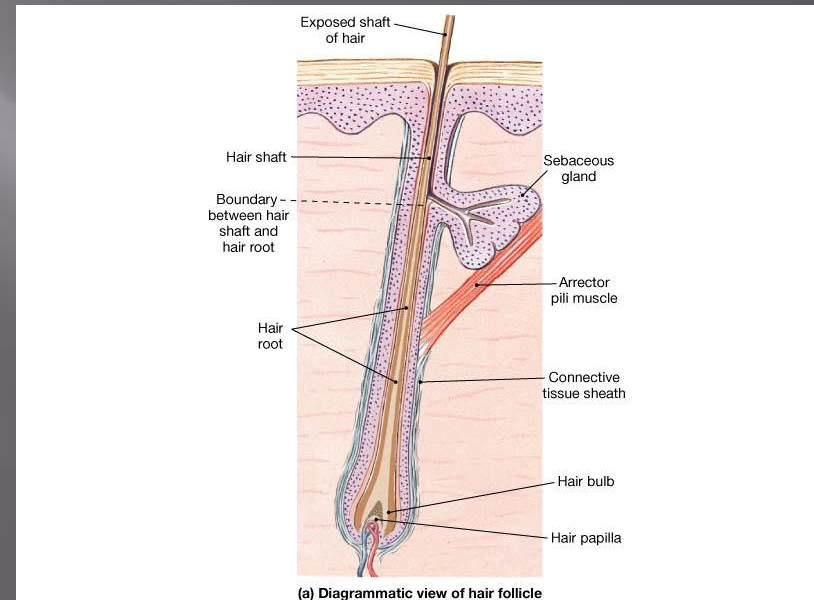
- Stabilization of skin while allowing for independent movement

Accessory Structures:

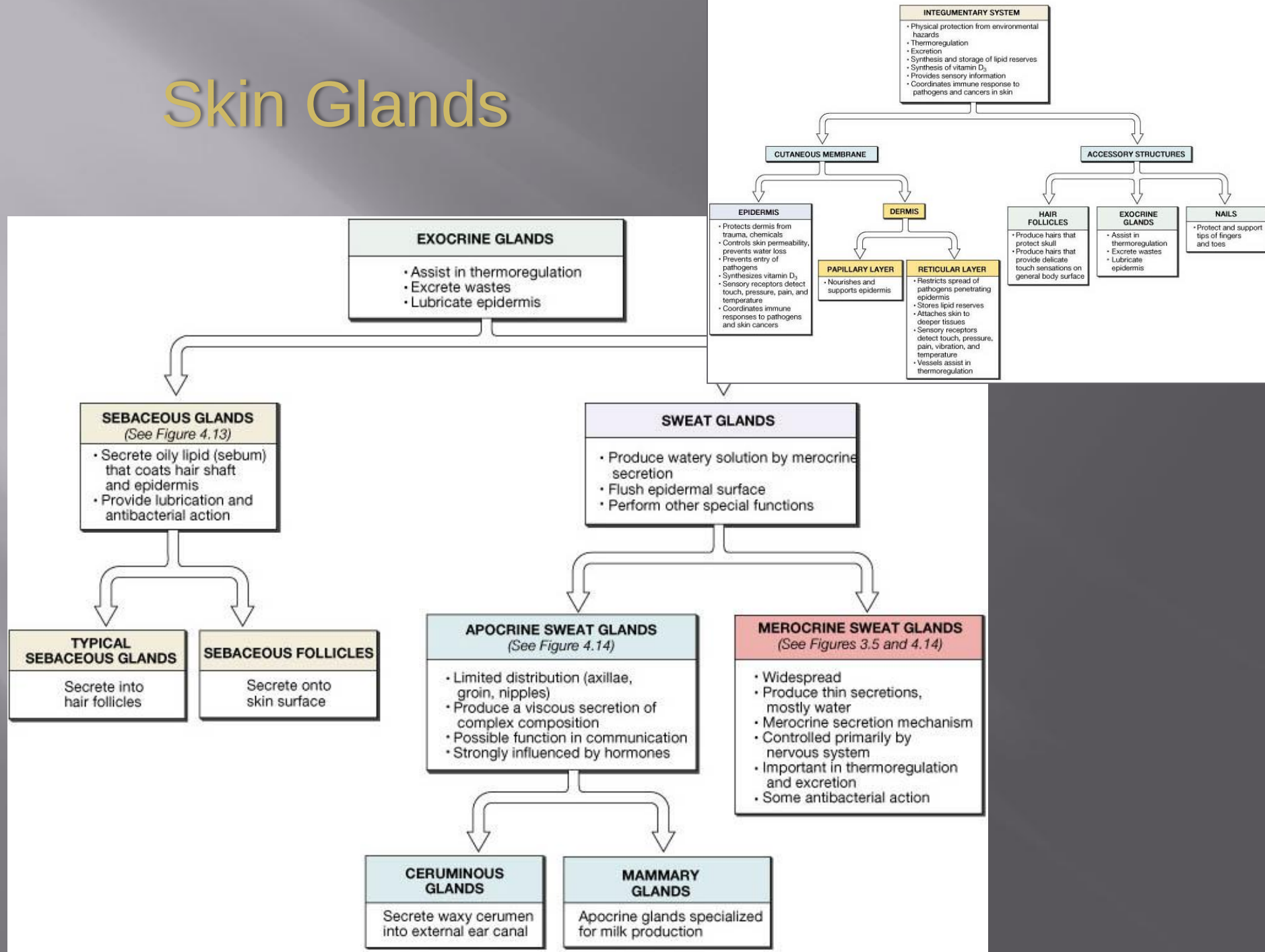
- ▣ Hair follicles and hair
- ▣ Glands
 - 1. Sebaceous Glands
 - 2. Apocrine glands
 - 3. Eccrine sweat glands
- ▣ Nails

Hair Follicles & Hair

- ▣ 5 million hairs/human body. (98% not on top of head)
- ▣ Three hair types (vellus – intermediate – terminal)
- ▣ Function ?
- ▣ Hair color
- ▣ Growth cycle

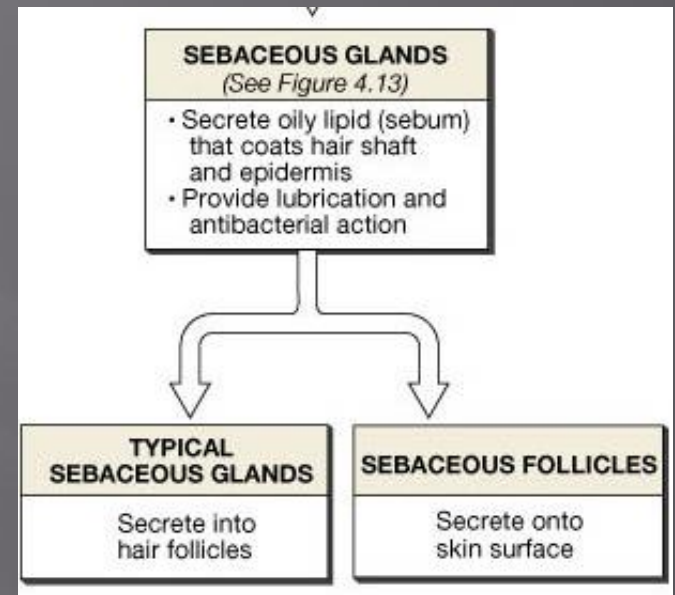


Skin Glands

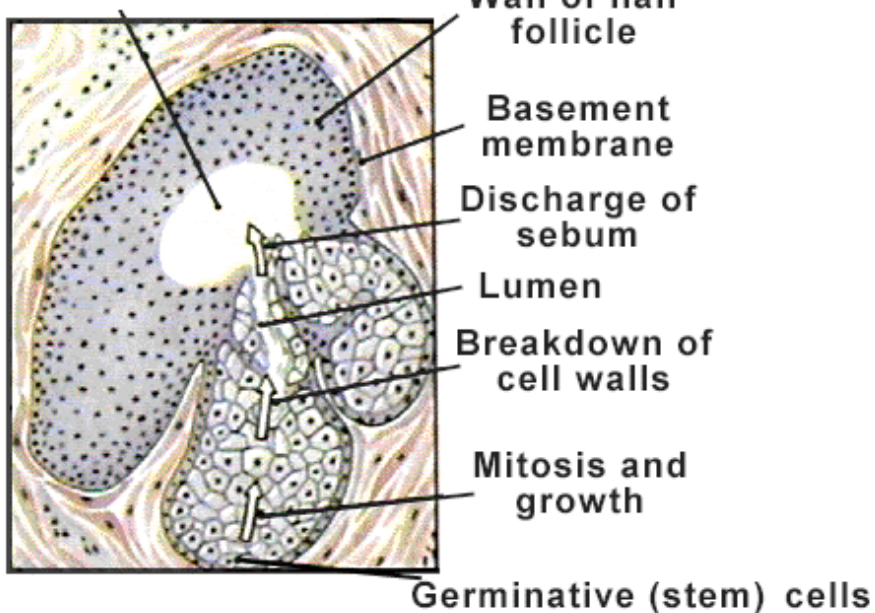


1) Sebaceous Glands

Sebum discharged mostly into hair follicles
(lubrication & bactericidal)



Hair removed

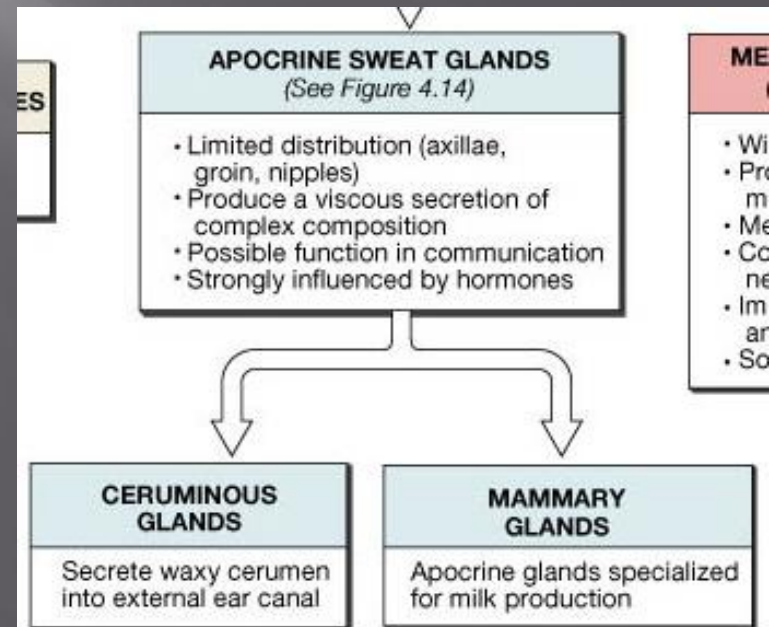


Sebaceous follicles, = Large sebaceous glands, discharge directly to epidermis

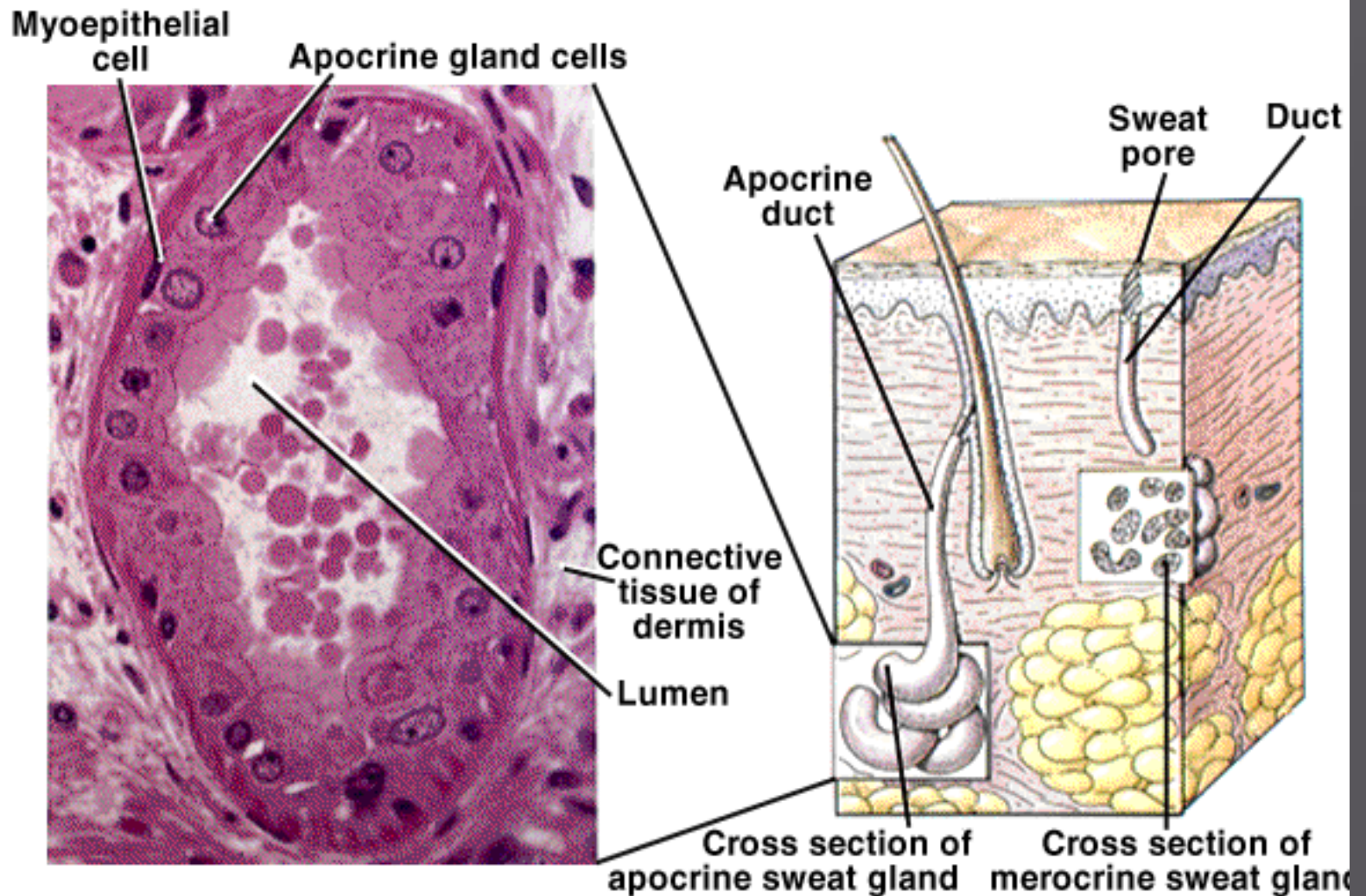
Folliculitis; furuncle (boil); acne

2) Apocrine Sweat Glands

- ❑ Empty into hair follicle
- ❑ Location: armpits, groin, nipples
- ❑ Viscous, cloudy secretion → good nutrient source for bacteria (odor !!)
- ❑ Secretion may contain Pheromones
- ❑ Secretion begins at puberty and is stimulated during emotional distress (cold sweat)



Apocrine Sweat Glands



3) Merocrine (Eccrine) Sweat Glands

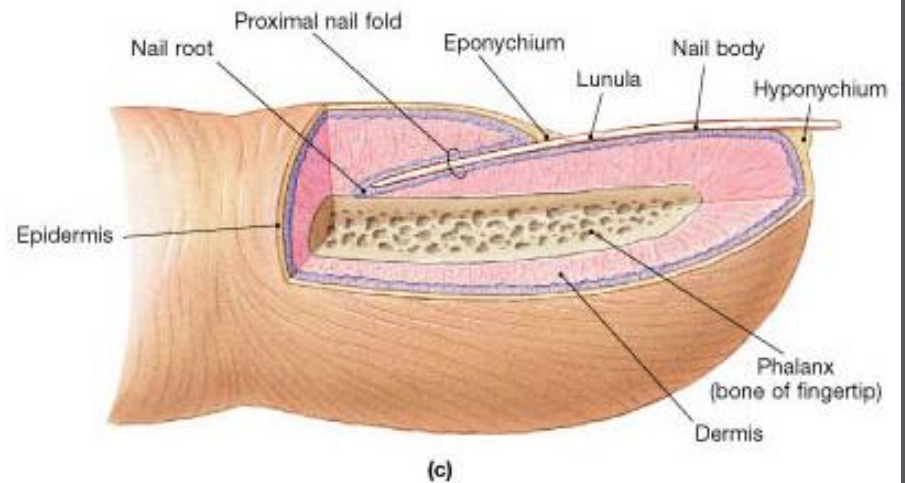
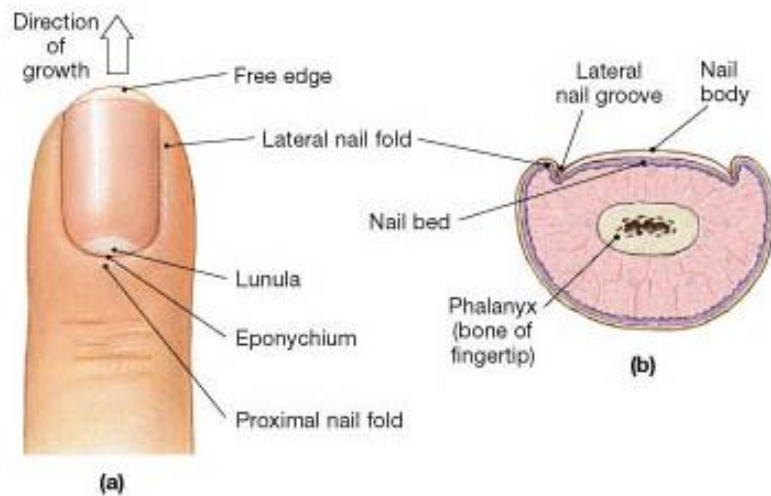
- ▣ Merocrine secretion
- ▣ Empty directly onto skin surface
- ▣ Location: most all over body (esp. abundant on palms & soles: ~ 500/cm²)
- ▣ Clear, watery secretion (99% H₂O; rest NaCl + some waste products)
- ▣ Sensible perspiration; *Function: ?*

MEROCRINE SWEAT GLANDS

(See Figures 3.5 and 4.14)

- Widespread
- Produce thin secretions, mostly water
- Merocrine secretion mechanism
- Controlled primarily by nervous system
- Important in thermoregulation and excretion
- Some antibacterial action

Nails



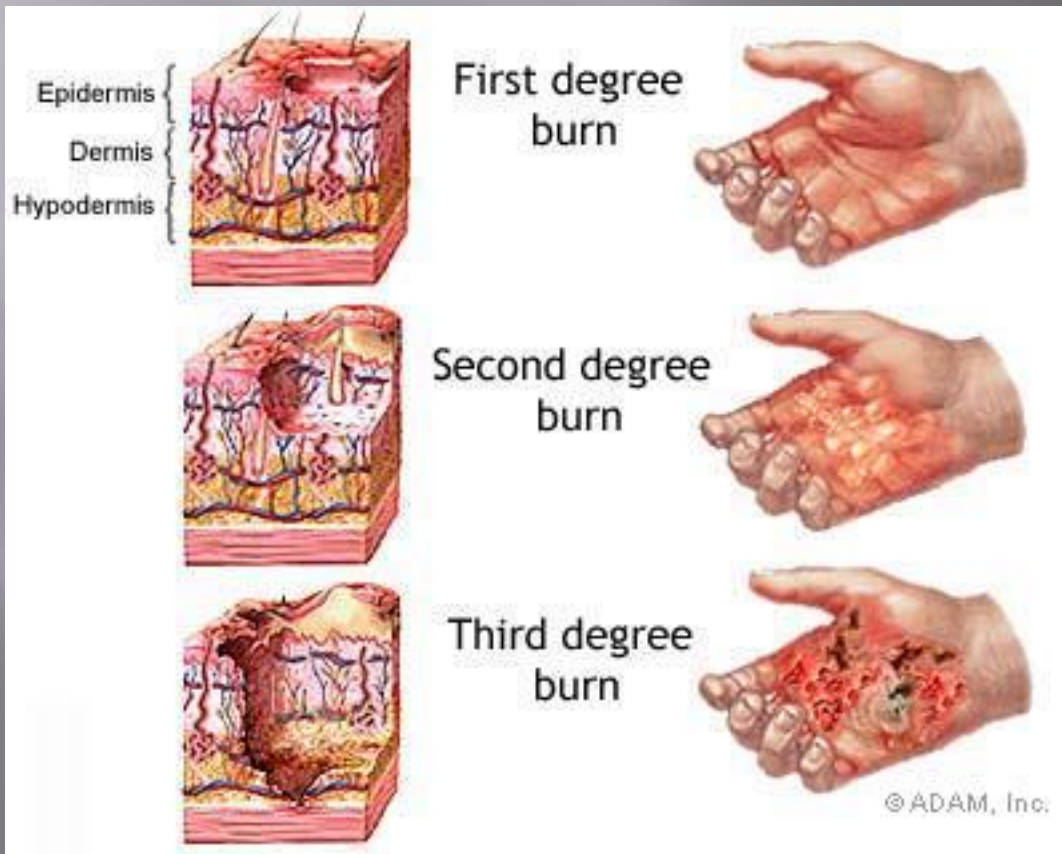
For purpose of completion:

Other integumentary Glands:

- ▣ **Mammary glands:** Modified apocrine sweat glands
- ▣ **Ceruminous glands:** Modified sweat glands in ears



Skin Pathology



Skin Cancers

1. Basal Cell Carcinoma (Epithelioma)
 1. Most common, not malignant
2. Squamous Cell CA
 1. Stratum spinosum
3. Melanoma



Skin and Aging Process

